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Original Article

Association between the Socio-Economic Indicators and Infant Mortality Rate (IMR) in Iran

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Abstract

Background: Infant mortality is one of the main indexes in the assessment of a society's access to the primary health care services. Many factors are involved in this regard. The present study aimed at determining the structural association between socio-economic variables and the rate of infant mortality rate.

Methods: The required data and information were collected from the multiple indicator cluster surveys (MICS,1998), reports of the Statistical Centre of Iran (SCI) from the population indices in 2003, the project of Incomes and Costs of the Iranian Families (2002) and the National Health Survey on Iran (NHS- 1999). In this study dependent variable was IMR and independent variable was demographic and socioeconomic factors. The data were analyzed by Path Analysis method.

Results: According to the standardized coefficients, the illiteracy rate of the women aged 15-46 years is one of the main factors that, not directly but indirectly awareness, attitude and performance of the women, increases IMR by as much as 0.8, partly about 0.3 due to the lack of access to the health services such as urbanity and the percentage of caesarean. In addition, the index of consumption costs has direct and decreasing effect of about 0.353 on the infant mortality rate.

Conclusion: Reduction in women's illiteracy rate, increase of the families, welfare and the present of access to high quality services are the most important factors that decrease IMR.

Keywords: *Infant Mortality Rate (IMR), Socioeconomic Indicators, Path analysis*

Introduction

Infant mortality is indicative of a community's health and well-being as well as the extent to which its health and human services and other resources meet the needs of community's women and infants (1).

"UNICEF" believes that the rate of infant mortality is one of the important indexes of development. It originates from this fact that its reduction is possible only through improving the life condition of the majority of the people in a community (2).

One of the main goals for "Health for All by the year 2000" is the reduction of the infant mortality rate at most to 50 per 1000 live births (3), which is indicative of the importance of this index. According to the latest report of UNICEF, WHO, The World Bank and UN Population Division in 2007, the rate of infant mortality has now a decreasing trend. So that, within the years 1960 to 2006 by UNICEF regions, its rate has decreased from 120 to 49 per 1000 live births in the world (4). It is 161 in Sub-Sahara Africa, 95 in the Eastern and South Africa, 150, 83, West and Center Asia, 171, 107 Middle East and North Africa, 157, 36, in the South Asia, 157, 62, in the East Asia and Pacific, -, 23, in the Latin America and Caribbean, 103, 22, in the Central Easter Europe and the Common Wealth of Independent States (CEE/ CIS),-, 24, in Industrialized Countries, 32, 5, in developing countries, 140, 54, in Least Developed Countries, 168, 90, and in the Iran, 168, 34, per 1000 live births (4). Although the statistics indicate that these rates have been reduced within the recent years, but its rate in some countries is still significant.

Many studies conducted within last decades indicated that the health indicators have been im-

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proved largely in Iran. For instance, in 1976, the neonatal mortality rate (NMR), infant mortality rate (IMR) and under five mortality rate (U5MR) were 32, 93 and 135 per 1,000 live birth, respectively (5). However, they decreased to 18.6, 28.6 and 36 per 1,000 live birth, respectively, in 2006(6). MICS and DHS are estimated (NMR), (IMR) and (UFMR) less than17.7, 28.6 and 30 per 1,000 live births in Iran (7).

Infant mortality has decreased sharply over the past three decades: from around 154 per 1,000 live births in 1964 to about 26 per 1,000, 95% confidence interval, (CI: 19-36) in 2004. This implies child mortality level of 30 and 34 per 1,000 live births for females and males respectively (8).

The aim of the present study was to determine the structural correlation among the factors affecting the IMR in Iran using an advanced analytical method (known as Path Analysis) and their direct and indirect effects in the simultaneous equations.

Materials and Methods

Path analysis is an extension of the regression model, used to test the fit of the correlation matrix against two or more causal models, which are being compared by the researcher. The model is usually depicted in a circle-and-arrow figure in which single-headed arrows indicate causation. A regression is done for each variable in the model as a dependent on others, which the model indicates, are causes. The regression weights predicted by the model are compared with the observed correlation matrix for the variables, and a goodness-of-fit statistic is calculated. The best fitting of two or more models is selected by the researcher as the best model for advancement of theory (9-11).

In this study, infant mortality rate IMR was used as the dependent variable, the illiteracy rate of the women aged 15-46 yr, percent of urbanity, and caesarean, percent of employed women and family size were treated as the independent variables.

The main sources of the required data were the latest provincial reports 28 provinces in Iran, the multiple indicator cluster surveys MICS in 1998 by the Iran's Ministry of Health, Population and Development Datasheet of the SCI in 2003, the project of cost and income of the Iranian families by SCI in 2002, the National Health Survey in Iran (NHS) in 1999 and the Iran Demographic and Health Survey in 2000.

At the present study, the selection policy of the indicators was based on the availability of the information about them throughout the 28 provinces of the country. It is assumed that the selected indicators are indicative of the different aspects of health situation in Iran: the rate of women's illiteracy to measure their access to the knowledge on the benefit of health care and as the measure of their awareness; family expenses as the measure of access to and the quality of the health services; and finally the percent of urbanity, the women's employment and family size as the indexes of sociocultural situation of the society.

The multivariable statistical method of "Path Analysis" was used to analyze the obtained data and to determine the structure of the correlation among the variables, in which, the direct, indirect, and total effects of each variable in the structural equations were determined as well.

The path diagram represents the underlying structure of the variables effects within a given model, in which, the arrows represent the effect of one variable upon another (Fig. 1).

The arrows, connecting the correlated variables provide the direction of the paths, whereas, the path coefficients provide the strength of the association. The connections among the risk factors were based on the statistically significant correlations coefficients.

The real task of applying the path analysis was the construction of a path diagram that reflects the true situation as closely as possible.

Results

According to the results of a study by the Iranian Statistical Center in 2003 (2) the infant mortality rate in Iran was 32.1 per 1000 live birth for both genders and 66% of the total population live in the cities, family size is 4.4 for the total population, the percentage of illiterate females of 15-49 yr old was 24.8% for the total population, 35% of all deliver-

ies take place for cesarean and the percentage of employed women for the total population is 9.8% (Table 1).

Table 1 shows that 66% of the total population of Iran live in the cities. The highest percent of urbanity is in Qom province with 92.4% and next is in Tehran province with 85.1%. The lowest percentage of urbanity is in Hormozgan Province with 42.4%.

Family size is 4.4 for the total population of the country. The biggest family sizes are for the Khozestan and Sistan Balochestan provinces with 5.2 and 5.1, respectively, and the smallest family sizes are for the Tehran and Gilan provinces with 3.7 and 3.8, respectively.

It also shows that the percentage of illiterate females 15-49 yr old was 24.8% for the total population. The illiterate females were found in Sistan Balochestan province with 59% and the least illiterate females is found in Tehran province with 12.7.

As Table 1 shows the percentage of employed women for the total population is 9.8%. In addition, Gilan province with 21.3 and Khorasan province with 18.7% have the highest numbers of employed women, compared with Lorestan province, which has the least number (3.4%).

The results of simple correlation coefficient show that there is no significant relation between the family size (P= 0.81) and the percent of the employed women (P= 0.53). Therefore, the structural model between the IMR and the variables such as the illiteracy rate of the women aged 15-49 yr, caesarean percent, family expenses and urbanity percent was designed. The path diagram (Fig. 1) represents the underlying structure of the risk factors and IMR (standardized coefficients).

Table 1: IMR and Socioeconomics Indices in different provinces of Iran

Indices / Province	I.M.R (per 1000 live birth)	Cesarean (percent)	Illiteracy of women 15-49 (percent)	Urbanity (percent)	Consumption cost per person per year (1000 Reial)
Iran	32.1	35	24.8	66	16440
East Azerbaijan	37.9	40.3	35.4	64.8	20979
West Azerbaijan	43.2	24.7	46.1	57.3	15813
Ardebil	39.9	25.1	43.6	45	16138
Esfahan	29.6	41.6	16.1	80.5	21378
Ilam	46.5	23.2	36.4	57.9	13528
Bushehr	38.4	22.1	25.6	54.2	19240
Tehran	28.7	48.1	23.8	85.1	25176
Chaharmahal &Bakhtiyari	39	32	34.7	52.7	14279
Khorasan	44.8	27.7	26.9	61.5	13322
Khuzestan	36.5	27.5	29.9	63.7	19540
Zanjan	41.6	27.5	40.4	51.1	14107
Semnam	33.6	46.4	13.5	74	16147
Sistan&Baluchestan	54.6	6	59	48.3	13279
Fars	34.4	25.5	20	59.6	15128
Qazvin	32.9	29.5	24.2	64.6	17286
Qom	33.9	42.6	21.7	92.4	19058
Kordestan	53.8	24.3	52.2	56.8	13379
Kerman	41.2	26.6	27.2	59.5	15237
Kermanshah Kohgiluyeh & Boyerahmad	42.8	28.3	35.4	63.6	13872
Golestan	48.4	18.3	38.4	48.1	12101
Gilan	41	35	34	43.5	15685
Lorestan	28.8	47.2	24	53.1	22680
Mazandaran	43.7	22.2	35.4	56.1	14379
Markazi	36.6	49.2	20.4	49.5	14298
Hormozgan	36.9	39.4	25	63.5	17332
Hamadan	39.2	13.4	37	41.5	14007
Yazd	40.6	34.6	30.5	53.9	13653

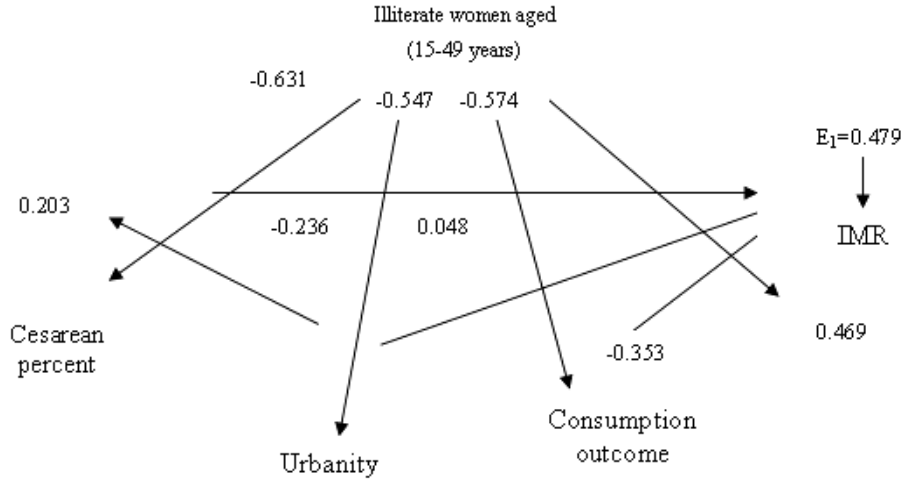

Fig. 1: Path diagram, path standardized coefficients of the risk factors and IMR

In addition, Table 2 shows the calculated values of the rate of correlation, direct, indirect and total effects of each of the prognostic and non-prognostic variables in the finalized and accepted structural model among the variables.

Table 2: Direct, indirect and total effects of each prognostic and non- prognostic factor on IMR in the structural model

Indices	Relation	IMR	Illiterate women 15-49 Age	Cesarean percent	Family consumption cost
Illiterate women aged 15-49 yr	Correlation	0.814			
	Direct	0.469			
	Indirect	0.347			
	Total	0.816			
Cesarean percent	Correlation	-0.728	-0.724		
	Direct	-0.236	-0.613		
	Indirect	-	-0.111		
	Total	-0.236	-0.724		
Family consumption cost	Correlation	-0.719	-0.602	0.508	
	Direct	-0.353	-0.574	-	
	Indirect	-	-	-	
	Total	-0.353	-0.574	-	
Urbanity percent	Correlation	0.561	-0.547	0.538	0.671
	Direct	0.048	-0.547	0.203	-
	Indirect	-0.047	-	-	-
	Total	0.001	-0.547	0.203	-

The results of the standardized coefficients show that the illiteracy of the women aged 15-49 yr is an important factor in increasing IMR (0.816), part of which is indirect (0.347) through urbanity and cesarean percent. Both family consumption cost and cesarean have decreasing effect on IMR of about (-0.357) and (-0.235) respecting. Urbanity has direct increasing effect on IMR (0.048) but it has indirect decreasing effect through cesarean percent of about (-0.047).

Discussion

The first year of life plays critical and important role in developing the health infrastructure and improving the quality of life. The rate of infant mortality is a significant and valuable indicator for a society's health situation and mortality level. This statistical index not only shows the quantity and the number of mortalities, but also it is indicative of the quality of life. Infant death is caused

by different factors, as it also causes various problems to the families as well as to the society. According to the results of the present study, the total family consumption costs has the most decreasing effect on IMR, in other words, the increased potential of the families for consumption costs which is indicative of the improved economical and welfare conditions, is one of the important factors of IMR decrease.

Hadjian in a study on the association between the rate of infant mortality (IMR) in the world and the Gross National Product (GNP) of some 145 member countries of WHO and UNISEF, showed that there is a logarithmic decrease between the two variables(12).

Szot (13) studied relationship between some economic indicators and infant mortality in Chile, showed that there is an inverse association between the Gross National Product and per capita and Real Salary Index and a direct relationship between inflation and unemployment rates with an increased infant mortality.

It seems that in the families that most part of their income is spent on consumption costs, there are more possibilities of paying attention to the mother's nutrition, family's welfare and pre-and during the pregnancy health cares as well as neonatal period cares that overwhelming, have important roles in decreasing IMR (13).

Overall, we can say that the index of caesarean is indicative of the level of access to high quality health services. Improving the system of providing health services and facilitating the access of the individuals to such a high quality health services necessarily improves the health situation of the society.

One of the important features and results of the present research was to study the role of women's education on IMR. The illiteracy rate of the women aged 15-49 yr is indicative of the level of their awareness and knowledge about the health cares and a measure of their access to the knowledge on benefit of the health cares, (which showed the highest effect in our proposed model) and is one of main factors of the increased IMR. Therefore, education as the first step to obtain awareness and change in the attitude and behavior of the individuals is of great importance and there is no doubt that it influences all aspects of one's individual and social life.

Curtis and Steele (14) who used DHS data from Bolivia, Peru, Kenya, and Tanzania in their study on neonatal mortality, found that the level of maternal education was highly significant in all the countries except Tanzania, education significantly lowers infant mortality, male education has no statistically significant effect on IMR.

Other studies have also established the existence of some relationship between level of education and utilization of health care facilities. High level of education has a strong positive effect on the use of modern services and that more educated mothers are more aware of the existence of treatment options as well as the benefits that treatment can have on their health (15-17).

According to the joint statement of WHO, UNFPA, UNICEF and World Bank in the International Conference (Geneva, 1999) and based on the results of their studies in order to reduce the maternal and infant mortalities, significant outcome can be achieved through interventions designed to improve the health of mother and her access to health care during the labor, delivery and the critical hours immediately after the child birth (18).

Of the nearly 8 million infant deaths each year, around 65% occurs during the neonatal period before the age of one month, 3.4 millions of these neonatal deaths occur within the first week of life after birth, largely because of inadequate or inappropriate health care during the pregnancy, delivery or the first critical hours after the birth (19).

Immunization against the epidemic diseases of childhood and better control of diarrhea diseases cause to reduce IMR, while the role of women's literacy in each case is obvious.

There was a negative relation in the present study between the women's illiteracy rate and the caesarean percent, family consumption costs and urbanity percent.

The results published by the International Conference of Geneva 1999 revealed that low social

and economic status of girls and women is a fundamental determinant of the maternal mortality in many countries, which limits the access of girls and women to education and good nutrition as well as economic resources needed to pay for the health care of the family planning services (20). A population based study in Norway showed an inverse association between socioeconomic groups and risk of infant death from 1967 to 1998. In this study parents education was used as a measure of socioeconomic status (21). In a study in a Brazilian city, the mortality rate among infants was negatively related to geo-economic classification, with poor areas of the city having the highest rates and rich areas the lowest (22). A Chilean study from 1990 to 1995 showed clear gradient of infant mortality rates according to the mother level of education. The highest rate of infant death was among those with no education (23). An Indonesian study showed that the risk of infant mortality among households of low welfare index was almost twice that of households with high welfare index (24). In a health surveys in the India a rating of socioeconomic position taking into account factors including income, education, housing conditions and land ownership. The lowest socioeconomic status group had the highest child death rate (25). A study an inequality in child mortality in nine developing countries, found that countries with a more inequality consumption distribution in the population tended to have greater inequalities in child mortality than those with an equal distribution of consumption (26). In a study, a socioeconomic inequality and infant mortality rate conducted in Iran in 2000. This study showed that there is a reverse association between infant mortality rates and socioeconomic status across Iran as a whole and within most of its provinces (27). Movahedi et al. found an acceptable improvement in many of the health indicators in rural areas of Iran during the recent 1-2 decades. They found the inequality decrease in some of the indicators in recent years (28). As we observed in the present study, reduction in women's illiteracy rate, increase of the families' welfare and the percent of access to high quality services are the most important factors that decrease IMR.

Of the other results of this research is the analysis of the effect of urbanity percent, which seems to have no direct effect on IMR. But it's most important effect is through decreasing the rate of illiteracy and increasing the rate of caesarean, which therefore, has indirectly important role in decreasing the rate of infant mortality. The conclusion is in order to decrease the rate of infant mortality, the authorities should design, and implement programs to decrease the rate of illiteracy among the women aged 15-49 yr, increase the families' welfare and the possibility of their access to high quality health services.

The findings of this study being an ecological one are more likely suffer from ecological fallacy. In other words, the observed association between variables is correct in an aggregated level, which means it does not necessarily represent the association at the individual level.

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